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REVIEWS

The Environment of Vertebrate Life in the Late Paleozoic of North America; A Paleogeographic Study. By E. C. CASE. Carnegie Institution: Washington Publication No. 283, 1919. Pp. 273, figs. 8 and two correlation tables.

This publication will be welcomed by all geologists as a signal contribution to the interpretation of conditions of the late Paleozoic. Dr. Case is well qualified to summarize the conditions surrounding the vertebrates, and to draw conclusions as to the influence of the environment on their development and distribution.

In the first chapter the various methods of attack and the complexity of the factors in any paleogeographic problem are briefly presented. There follows a summary of late Paleozoic rocks in the several provinces of North America. For the most part the descriptions are quotations from other writers and are not intended to present new material. Quite apart from the obvious purpose, this summary will be of great use to the student, gathered as it is from a voluminous literature on the subject. The selections are well made; they are representative of current opinion, to the point, and show no evidence of an attempt on the part of the compiler to prove a point. The full usefulness is slightly impaired, perhaps, by the absence of an index. The accompanying correlation tables differ little from generally accepted views.

Contrary to what might be expected, the author makes no attempt to fix the lower boundary of the Permian. Throughout the work he refers repeatedly to Permo-Carboniferous times in the sense of a transition period between the Pennsylvanian and the closing events of the Paleozoic. He makes a sharp distinction, however, between Permo-Carboniferous *times* and Permo-Carboniferous *conditions*, and emphatically states that these two things are not necessarily coincident. Perhaps the most important deduction reached, together with the dependent conclusions, is that Permo-Carboniferous conditions prevailed in the east, starting with Mid-Conemaugh time, and reached the southwest considerably later. The deposition of red sediments is taken to mark the introduction of important new climatic and physiographic conditions and accompanying changes—Permo-Carboniferous conditions. These conditions spread very slowly from east to west and, therefore, have left a record oblique to stratigraphic lines (see Fig. 1).

The environment of an organism, "the sum total of all its contacts with the external world," determines to a great extent its structural changes and the distribution of its kind. The equable, humid climate and topographic uniformity of the typical (lower) Pennsylvanian produced an abundant though fixed food supply—vegetation. Since new forms arise only through isolation (not necessarily geographic isolation) the monotony of this environment acted as a repressive force, checking the expansion of the amphibians and reptiles into new forms. "Environmental monotony would result in the persistence of older and simpler types, because the variants, possibly being constantly produced, would not have a chance to develop."

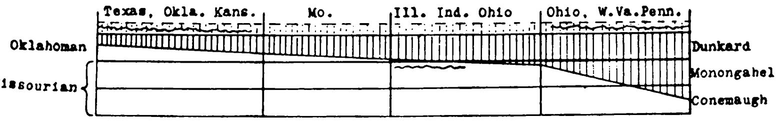

FIG. 1.—"Diagram illustrating in a schematic way the relative position of the sediments formed under Permo-Carboniferous conditions. The land was rising from east to west, but there was continuous sedimentation in the eastern region at the western edge of the rising land of Appalachia. As the land rose slowly the red beds spread toward the west, occupying relatively higher positions in the stratigraphic column. It is difficult to illustrate the actual conditions in the diagram, because the 'red beds conditions' were advancing, but the wavy lines indicate the surface of the ground relative to these conditions. In Pennsylvania and West Virginia deposition was continuous during the conditions. In Illinois and Indiana deposition had ceased by the time the conditions reached that far west; in Kansas, Oklahoma, and Texas 'red-bed conditions' reached the region in time to affect only the uppermost Paleozoic deposits. The upper limit of the red-bed conditions is not known, and so the upper limit of the wedge is indicated by a dotted line" (from Case, p. 192).

Permo-Carboniferous conditions included a cool to cold, arid or semiarid climate, resulting from deformation throughout various parts of the world, the presence of volcanic dust in the air, and a diminution of the carbon-dioxide content of the atmosphere. This made for a great variety in environmental conditions and destroyed the repressive bounds to vertebrate expansion. "The fauna, long restrained from any expression of evolutionary tendencies, full fed, and in the vigor of its youth, responded at once to the change, and new forms appeared so suddenly as to be unheralded in the preserved remains."

These new forms appeared at higher and higher horizons as the Permo-Carboniferous conditions spread slowly westward and "to correlate widely separated groups of beds as synchronous in deposition because of a similarity, even approaching identity, in the fauna or flora would be a serious error."

M. G. M.

Upper Cretaceous Floras of the Eastern Gulf Region in Tennessee. Mississippi, Alabama, and Georgia. By E. W. Berry. U.S. Geological Survey, Professional Paper 112, 1919. Pp. 177, pls. 33, figs. 12.

Another publication is added to the already considerable list which is making fossil plants such an important part of our geological knowledge of the southeastern United States.

The Upper Cretaceous of the eastern Gulf region extends in a lunate outcrop around the southern end of the Appalachians. It is subdivided into the Tuscaloosa formation, the Eutaw formation, the Selma chalk, and the Ripley formation. These formations, with the exception of the Selma, are made up largely of cross-bedded sands, with associated clays.

The most extensive flora is that of the basal Tuscaloosa formation, comprising 151 species of which the majority are dicotyledonous angiosperms. The place of origin of this dominant element is left unsettled, but the idea of their dispersal from an Arctic area is consistent with the evidence offered by this and other Cretaceous floras. This flora is made up largely of lowland coastal types, and its ecological character is in accord with other evidence of the delta origin of the formation. The plants make up an assemblage which most nearly resembles the modern warm-temperate rain forest. In view of their northward range into Greenland, they may be said to indicate a climate mild over wide areas.

The Eutaw flora comprises 43 species, most of which come from the basal portion of the formation and closely resemble those from the Tuscaloosa formation. The physical conditions suggested by this flora are similar to those for the Tuscaloosa.

The Selma chalk, which is described as a lithologic rather than a chronologic unit, is entirely marine and contains no plant remains. The Ripley formation contains a few poorly preserved plant fossils.

The Tuscaloosa formation may be correlated, on the basis of its contained flora, with the upper part of the Raritan and with the Magothy